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EVALUATION OF POTENTIAL HAZARD
TREES AND PEST CONDITIONS
AZTEC RUINS NATIONAL MONUMENT
AZTEC, NEW MEXICO

MAY 1991

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ABSTRACT

At the request of Terri Nichols, Chief of Interpretation and Resources Management, an evaluation of potential hazard trees and pest conditions were conducted at Aztec Ruins National Monument. Participating in this evaluation were Terri Nichols, Gerry Hoddenbach, Regional Integrated Pest Management Coordinator, Southwest Region, National Park Service, and James Brown and Fel Velasquez, Maintenance Division, Aztec Ruins National Monument. Terri was concerned about potential hazards posed by the older cottonwood and elm trees located near the visitor center, picnic area, and maintenance shed. All of the trees examined were highly valued because of the shade and scenic value they provide the visitor center and picnic area. This report; (1) summarizes the tree defects, hazards, and pest conditions detected during this survey, and (2) provides management alternatives for hazard tree management.

OBJECTIVES

The objectives of this field examination were to: (1) Identify hazardous trees occurring at the Aztec Ruins Visitor Center and picnic area, and (2) evaluate the incidence of existing pest conditions.

SURVEY DESIGN

The procedures followed during this survey are described in the "Inventory of Insects, Diseases, and Hazard Tree Incidence Work Plan for Developed Recreation Sites on National Forest System lands in the Southwest" (Rogers 1989). The survey design consisted of two parts: (1) A hazard tree survey and (2) an insect and disease pest incidence survey. A hazard tree is defined as any tree with both a structural defect that could cause the tree to fail and a potential target (ex., table, campsite, parking pad, toilet, etc.). Only trees located in areas of intensive public use and showing signs of structural defect (dead tops and/or branches, bole rot, exposed roots, etc.) were evaluated. Tree species, diameter breast height, location, defect, and hazard tree rating were recorded on the enclosed Hazard Tree Evaluation Forms (refer to Appendix).

The hazard tree rating system used is patterned on the procedures described by Johnson (1981) and involves the factors that contribute to tree failure such as dead limbs and weak forks, degree of lean, and signs of insect- and disease-caused damages. This system involves a two-part Failure/Risk rating, each part using a descriptive rating scale of High (H), Medium (M), and Low (L) to estimate probability of "Failure" and "Risk." The first part of this rating system is an estimate of the probability that the tree or major portions thereof will fail within the next five years; the second part of the rating system is an estimate of the probability that the failed tree, or portions thereof, will cause personal injury or damage to property if failure does occur.

The insect and disease pest incidence survey was a 100 percent tree survey conducted concurrently with the hazard tree survey. The following data were collected for each tree that exhibited insect, disease, and/or abiotic damages: Species, diameter at breast height (DBH), tree history, and damage code.

RESULTS AND DISCUSSION

The area surveyed at Aztec Ruins National Monument was a hardwood site consisting primarily of mature and overmature cottonwoods and elms. A total of 28 trees were rated for hazard. Twenty-six of these rated trees were cottonwoods and eight elms. Eleven of the trees examined for hazard were given a "high failure/high risk" rating, category "H/H", indicating they or portions thereof (limbs and branches) have a high probability of; (1) failing within the next five years, and (2) causing personal injury or property damage. All of these category 1 hazard trees (H/H) were located near, or adjacent to, high use trails (areas of intensive public access) or permanent structures (visitor center, maintenance building, picnic tables, or waste cans, etc.).

The large majority of the defects found at Aztec Ruins National Monument consisted of dead branches (limb defects). These dead branches were on trees located near and adjacent to high-use visitor trails leading to and from the visitor center, Ruins, and picnic area. Although dead branches are not necessarily all hazardous because the lack of moisture and foliage makes the smaller branches light, those with diameters greater than three inches and over six feet in length are potentially hazardous and should be removed (pruned) before they fail (break off). Timely removal of these dead branches will also prevent the entry of decay fungi and other microorganisms, promote rapid healing, and increase the longevity of the tree.

The number of hazard trees in each rating category or class is summarized in Table 1 below. Specific information on the hazard trees identified at Aztec Ruins National Monument, their defects, and locations are provided on the Tree Hazard Evaluation Forms in the Appendix.

Table 1. Summary of Hazard Trees by Rating Class, Aztec Ruins National Monument

	Number of Trees with Rating of:					
Site Surveyed	H/H[a]	H/M	M/M	M/H	M/L	L/L
Aztec Ruins National Monument	11	7	3	6	1	4

[a] Failure/Risk Rating: H = High, M = Medium, L = Low

The hazard tree ratings provided above are not recommendations for action. They are a professional estimate of the probability of tree failure and should be used by the land manager when developing hazard tree management plans on National Park Service lands. Highest priority should be given to category 1 trees (H/H), since they are the mest prone to failure within the next five year period and present the greatest risk to public safety and property. Trees in categories two to six (H/M, H/L, M/H, M/L, and L/H) should be monitored and as their hazard rating increase to the "High Failure/High Risk" category, (H/H), they should be pruned or removed as needed to maintain an acceptable level of risk. Tree removal should always be considered the last alternative.

The only other tree defect observed at Aztec Ruins National Monument was caused by wetwood or slime flux. These are terms applied to aqueous leakage, usually dark and rather foul-smelling, exuding from openings or wounds in trees. It is relatively common in cottonwoods and elms. The presence of wet wood is not a sign the tree is hazardous and it does not indicate decay in a tree because it is rarely associated with serious internal decay.

Wetwood originates from either the hardwood or sapwood and is caused by the presence of fermenting organisms (bacteria and yeasts) in affected tissues. These organisms create an internal pressure by producing carbon dioxide gas as one product of fermentation. This pressure aids in forcing out excess water resulting from a wetwood condition within the wood. Wetwood is generally present within a tree before the creation of the wound or opening through which the aqueous leakage is exuded. It can occur in an otherwise perfectly sound tree. Bacteria are usually, but not always, associated with this condition.

No other significant insect or disease related damages were observed during this field survey.

MANAGEMENT ALTERNATIVES

1. Do nothing. Trees, or portions thereof, rated as potentially hazardous will continue to decline and the probability of failure will increase. Trees at Aztec National Monument will continue to be damaged by natural causes, so the number of potential hazards will also increase. The probability of tree failure with property damage and personal injury will also increase.

2. Remove or lessen the probability of failure of hazard trees. The land manager is responsible for deciding the level of risk acceptable in an area. Hazard trees, or portions thereof, would be removed or treated until the decided risk level is reached. In many cases, pruning dead branches or dead tops would substantially reduce the probability of

failure. When pruning hazardous branches on hardwoods, such as cottonwoods and elms, drop-crotching (Figure 1, Appendix) is preferred over topping (Figure 2, Appendix). Remaining leaders on drop-crotched trees will produce foliage to inhibit latent shoots, encourage callus growth over wounds, and add to the longevity and attractiveness of the tree. Unlike drop-crotching, topping results in rapid sucker growth. Such shoots are weak and destroy the natural shape of the tree. For trees showing signs of internal decay, the thickness of sound wood in the outer shell determines relative safety. Trees that lean naturally usually are reinforced by compensatory growth. However, structural damage to leaning trees, such as severed roots, large basal cavities, and internal decay increase the probability of failure and threaten visitor safety (Johnson, 1981).

3. Remove the targets. Under this alternative, picnic areas and high-use visitor areas and trails that are identified as targets are closed to public use. Removal of or moving potential targets (picnic table, trash cans, signs, etc.) will remove the problem of hazard trees.

4. Develop a long-term vegetation management plan for tree maintenance and replacement, which reduces the incidence of insects and diseases and development of hazard trees. This may include activities such as: (1) Thinning densely clumped trees to promote individual tree vigor, (2) fertilizing to stimulate tree growth and vigor, (3) avoiding soil compaction, (4) scheduling annual inspections to identify and correct tree hazards, and (5) implementing a tree replacement program for replacing mature and overmature declining cottonwoods and elms.

5. A combination of alternatives 2 and 3. Alternatives two and three are not mutually exclusive and can be used in combination to solve specific problems in many areas.

REFERENCES

Johnson, D.W. 1981. Tree hazards: recognition and reduction in recreation sites. USDA Forest Service, Rocky Mountain Region, Lakewood, Colorado, General Technical Report R2-1, 17 p.

Mills, L.J., and K. Russell. 1981. Detection and correction of hazard trees in Washington's recreation areas. A how-to guide for recreation site managers. State of Washington Department of Natural Resources. DNR Report No. 42, 37 p.

Rogers, T.J. 1989. Inventory of insects, diseases, and hazard tree incidence workplan for developed and proposed recreation sites of national forest system lands, Southwest Region. Unpublished report. USDA Forest Service, Southwestern Region, Albuquerque, New Mexico, 38 p.

APPENDIX

TREE HAZARD EVALUATION

EXHIBIT B

Administrative unit NATIONAL PARK SYSTEM

Examined by _____

Site name AZTEC RUINS

Date MAY 7, 1991

Unit No. TREES NO	Tree location (azimuth and distance from fixed object) Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.b.h.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure[1] rating: High	Medium	Low	Risk[2] rating: High	Medium	Low	Additional comments
1	31' 190° FROM BACK VISITOR SIGN	CW	59.2		X		X	X	X			X		X			BR
2	150' 290° " "	CW	77.0		X	X	X	X		X		X		X			RR, BR, LD
3	150' 292° " "	CW	47.2		X	X							X			X	RR
4	28' 0° " "	CW	45.0		X	X	X	X	X			X		X			BR, LD
5	17' 48° " "	CW	31.9				X	X	X		X			X			LD
6	44' 100° " "	CW	40.0				X	X	X		X			X			LD
7	55' 340° FIRE FROM HYDRANT	CW	35.8			X	X	X	X		X				X		BW, LD
8	48' 350° " "	CW	35.3		X	X		X	X		X				X		BR, LD
9	55' 20° " "	CW	29.1			X			X				X			X	BW

*Defect abbreviations:
RR=Root rot
BR=Bole or butt rot
BW=Bole wound
BC=Basal cavity
LD=Limb defect
WF=Weak fork
C=Conk(s)
DT=Dead top
ER=Exposed roots

[1] Probability of a tree failing within the next 5 years.
[2] Probability of a tree hitting a potential target.

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit NATIONAL PARK SYSTEM

Examined by _____

Site name AZTEC RUINS

Date MAY 7, 1991

Unit No. TREE NO.	Tree location (azimuth and distance from fixed object) Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.b.h.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure[1] rating: High	Medium	Low	Risk[2] rating: High	Medium	Low	Additional comments
10	45' 70° From FIRE HYDRANT	CW	49.0				X		X		X				X		LD
11	6' 142° " "	CW	28.0		X		X	X			X			X			LD
12	40' 143° " "	CW	29.2				X		X		X				X		LD
13	29' 189° " "	CW	24.8				X			X	X				X		LD
14	32' 188° " "	CW	26.8		X		X	X	X		X			X			LD
15	68' 334° From TRASH CAN	ELM	20.5				X	X	X		X			X			LD
16	88' 352° " "	ELM	30.9		X	X	X	X	X		X			X			LD, BR
17	81' 84° " "	CW	48.1			X			X			X			X		BR
18	104 176° " "	CW	38.3			X	X	X	X			X			X		LD

*Defect abbreviations:
RR=Root rot
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[1] Probability of a tree failing within the next 5 years.
[2] Probability of a tree hitting a potential target.

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit NATIONAL PARK SYSTEM

Examined by

Site name AZTEC RUINS

Date MAY 7, 1991

Unit No. TREE NO.	Tree location (azimuth and distance from fixed object) Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.b.h.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure[1] rating: High	Medium	Low	Risk[2] rating: High	Medium	Low	Additional comments: *Defect abbreviations: RR=Root rot BR=Bole or butt rot BW=Bole wound BC=Basal cavity LD=Limb defect WF=Weak fork C=Conk(s) DT=Dead top ER=Exposed roots
19	50' 220° FROM TRASH CAN	CW	24.8			X	X		X		X				X		LD
20	5' 36° FROM METER BOX	CW	44.0				X	X	X		X			X			LD
21	19' 322° FROM FIRE HYDRANT	CW	34.0				X	X		X		X				X	LD
22	16' 255° " "	CW	27.5				X	X		X		X			X		LD
23	36' 248° FROM EAST SIGN ON ISLAND	CW	34.0				X	X	X		X				X		LD
24	19' 264° " "	CW	35.0				X	X	X		X			X			LD
25	11' 190° " "	CW	30.3				X	X	X		X			X			LD
26	60' 130° " "	CW	25.0				X	X			X			X			LD
27	87' 250° " "	CW	20.0				X	X	X			X		X			LD

[1] Probability of a tree failing within the next 5 years.
[2] Probability of a tree hitting a potential target.

TREE HAZARD EVALUATION

EXHIBIT 8

Administrative unit NATIONAL PARK SERVICE

Examined by

Site name AZTEC RUINS.

Date MAY 7, 1991

Unit No. TREE NO	Tree location (azimuth and distance from fixed object) Abbreviations: TO=Toilet TB=Table FR=Fire ring PP=Parking pad TP=Tent Pad WH=Water hydrant BG=Bridge TC=Trash can TD=Trailer dump	Species	D.b.h.	*See abbreviations Type of defect: Leaning (angle of lean °)	Uprooting, root rot, butt rot, basal cavity	Bole wounds, bole cankers, decay (conks)	Weak fork, limb defect, brooms, dead top	Potential targets: Permanent structure, parked vehicle, people	Temporary structure, high-use trails	Low-use trails, signs	Failure[1] rating: High	Medium	Low	Risk[2] rating: High	Medium	Low	Additional comments
28	BONEYARD NEXT TO GREEN METAL SHED	CW	200				X	X	X		X			X			LD

*Defect abbreviations:
RR=Root rot
BR=Bole or butt rot
BW=Bole wound
BC=Basal cavity
LD=Limb defect
WF=Weak fork
C=Conk(s)
DT=Dead top
ER=Exposed roots

[1]Probability of a tree failing within the next 5 years.
[2]Probability of a tree hitting a potential target.

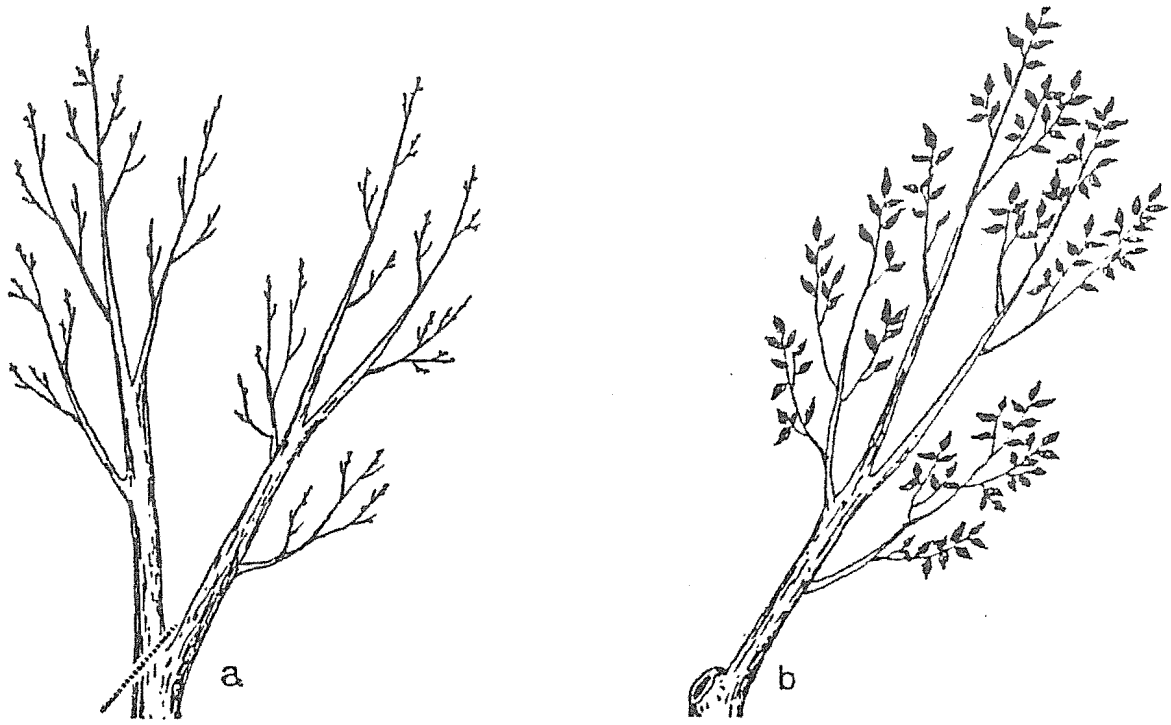

Figure 1 a. Drop-crotching to remove a limb. Remaining leader will produce foliage (b) to inhibit latent shoots and encourage callus growth over wound.

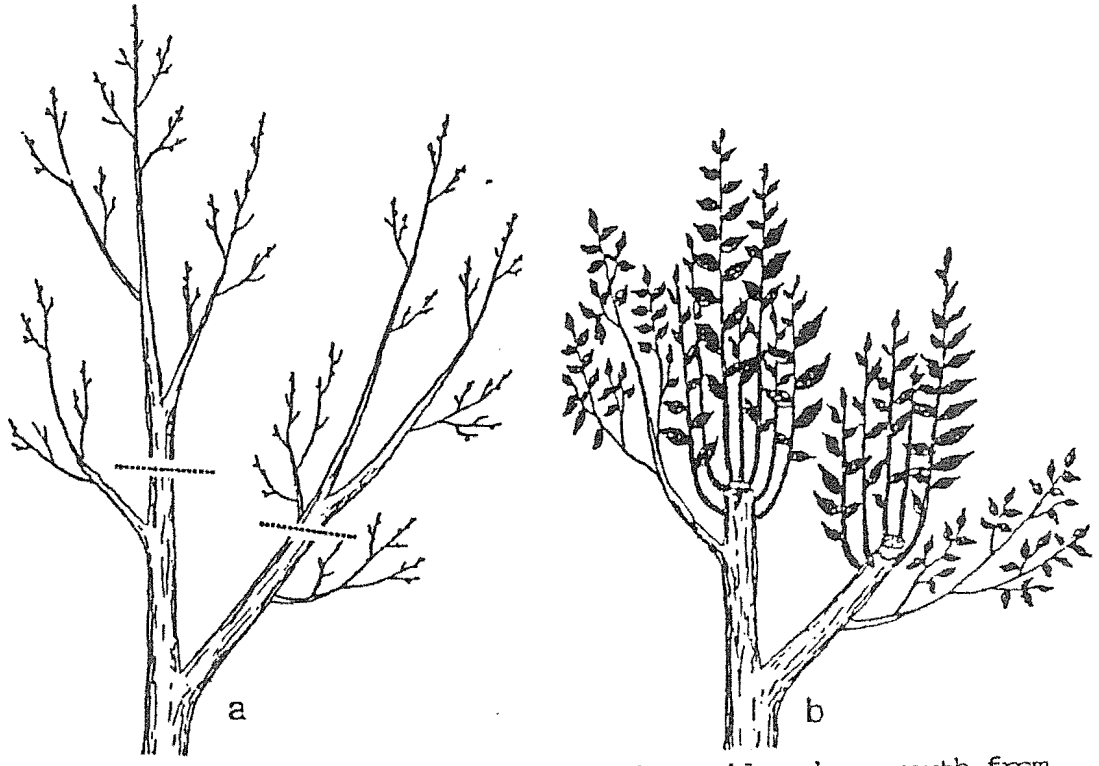

Figure 2 a. Topped trees will result in rapid sucker growth from latent buds (b). Such shoots are weak and destroy the natural tree shape.